Serum Aminotransferases Levels in Obese and Normal Individuals in Tertiary Care Centre: A Case-Control Study

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ABSTRACT

Background and Objectives: Obesity represents a significant global health challenge with potential metabolic complications. This case-control study aimed to comparatively evaluate serum aminotransferase levels in obese and normal-weight individuals to understand the relationship between obesity and hepatic enzyme alterations.

Methods: A Case-Control study was conducted in a tertiary care centre involving 100 participants (50 obese and 50 normal-weight controls), aged 20-60 years. Participants were classified based on Body Mass Index (BMI). Serum levels of Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Alkaline Phosphatase (ALP) were measured using standardized biochemical techniques. Demographic data, anthropometric measurements, and enzyme levels were systematically recorded and statistically analyzed.

Results: Significant differences were observed in serum aminotransferase levels between obese and normal-weight groups. Mean ALT levels were 62.4 ± 22.7 U/L in obese participants compared to 35.2 ± 8.9 U/L in controls ($p<0.001$). Similarly, AST levels were 54.6 ± 18.3 U/L in obese individuals versus 32.7 ± 6.5 U/L in normal-weight participants ($p<0.001$). The prevalence of elevated enzyme levels was substantially higher in the obese group: 38% for ALT >50 U/L, 32% for AST >40 U/L, and 28% for ALP >75 U/L. Odds ratios demonstrated a significantly increased risk of enzyme elevation in obese participants (ALT OR 7.42, 95% CI 2.31-23.85).

Conclusion: The study reveals a significant association between obesity and elevated serum aminotransferase levels, suggesting potential hepatic metabolic alterations in obese individuals. These findings underscore the importance of comprehensive metabolic monitoring and early interventions in obesity management.

Keywords: Aminotransferases, Body Mass Index, Liver Enzymes, Metabolic Diseases, Obesity.

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Introduction

Obesity has emerged as a significant global health challenge in the 21st century, with its prevalence reaching epidemic proportions worldwide. The World Health Organization reports that global obesity has nearly tripled since 1975, with over 650 million adults classified as obese in 2016.[1] This excessive accumulation of adipose tissue is associated with multiple metabolic derangements, including alterations in liver function.[2]

Non-alcoholic fatty liver disease (NAFLD), characterized by hepatic steatosis in the absence of significant alcohol consumption, is strongly associated with obesity and is now recognized as the hepatic manifestation of metabolic syndrome.[3] The spectrum of NAFLD ranges from simple steatosis to non-alcoholic steatohepatitis (NASH), which can progress to cirrhosis and hepatocellular carcinoma.[4]

Serum aminotransferases, particularly alanine aminotransferase (ALT) and aspartate aminotransferase (AST), are widely used as markers of hepatocellular injury. These enzymes are released into the circulation when liver cells are damaged, making them valuable diagnostic tools for assessing liver health.[5] Recent studies have suggested that elevated aminotransferase levels may be more common in obese individuals, even in the absence of other risk factors for liver disease.[6]

The relationship between body mass index (BMI) and liver enzymes has gained increasing attention, with several studies demonstrating a positive correlation between BMI and aminotransferase levels.[7] However, the exact mechanisms linking obesity to elevated liver enzymes remain incompletely understood. Proposed pathways include insulin resistance, oxidative stress, and chronic inflammation associated with excess adipose tissue.[8]

The clinical significance of elevated aminotransferases in obese individuals extends beyond liver health. Studies have shown that elevated liver enzymes may predict the development of type 2 diabetes and cardiovascular disease, independent of traditional risk factors.[9] This suggests that monitoring aminotransferase levels could have prognostic value in obese patients.[10]

Despite the growing body of evidence linking obesity to altered liver function, there is limited data from Indian populations, where genetic, dietary, and environmental factors may influence this relationship differently compared to Western populations.[11] This study aims to compare serum aminotransferase levels between obese and normal-weight individuals in a tertiary care setting, contributing to our understanding of the metabolic consequences of obesity in the Indian context.

Methodology

Study Design and Setting

This case-control study was conducted at the Department of General Medicine in a tertiary care hospital over a period of 18 months. The study protocol was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment.

Study Population and Sample Size

The study population consisted of adults aged 18-65 years attending the outpatient department. Cases were defined as obese individuals with BMI ≥ 30 kg/m^2 according to WHO criteria for Asian populations, while controls were normal-weight individuals with BMI between 18.5-22.9 kg/m^2. The sample size was calculated using the formula for case-control studies, assuming 95% confidence level, 80% power, and an anticipated odds ratio of 2.5 for elevated aminotransferases in obese individuals based on previous studies. This yielded a minimum required sample size of 50 cases and 50 controls.

Selection Criteria

Participants with a history of alcohol consumption, viral hepatitis, autoimmune hepatitis, drug-induced liver injury, or other known liver diseases were excluded. Additionally, individuals with diabetes mellitus, hypothyroidism, pregnancy, or those taking medications known to affect liver enzymes were not included in the study. Controls were age and gender-matched with cases to minimize confounding factors.

Inclusive Criteria

- Aged between 18 to 50 years
- Obese Individuals that is a BMI 30.0 and More as CASES
- Healthy Individuals Attending Routine Health check-ups/Blood Donations with BMI between 18.5 to 25 as Controls.

Exclusive Criteria

- Age <18 years and >50 years
- Diabetes Mellitus
- Abnormal lipid Profile
- Patient with evidence of Viral Hepatitis

- Patients with a history of consumption of Hepato-toxic drugs in Past one month
- Patients with a history of Hospitalization in past one month.
- Alcoholics

Ethical Clearance

Prior to the commencement, the ethical clearance was obtained from Institutional Ethics and Research Committee, S. Nijalingappa Medical College and Hanagal Shri Kumareshwar Hospital and Research Centre, Bagalkote, Karnataka, India.

Data Collection and Measurements

The study was conducted was conducted at the Dept. Of General Medicine, S. Nijalingappa Medical College and Hanagal Shri Kumareshwar Hospital and Research Centre, Bagalkote, Karnataka, India.

A detailed medical history was obtained from all participants using a structured questionnaire. Anthropometric measurements including height, weight, waist circumference, and hip circumference were recorded using standardized techniques. Height was measured using a stadiometer with participants standing barefoot, and weight was measured using a calibrated electronic scale with participants wearing light clothing. BMI was calculated as weight in kilograms divided by height in meters squared.

Laboratory Analysis

Blood samples were collected from all participants after an overnight fast of 12 hours. Serum ALT and AST levels were measured using the International Federation of Clinical Chemistry (IFCC) method on an automated analyzer. The upper limit of normal was defined as 40 IU/L for both enzymes based on our laboratory reference range. Quality control measures were implemented, including regular calibration of equipment and the use of control samples.

Information regarding physical activity, dietary habits, and other lifestyle factors was collected using a validated questionnaire. Physical activity was categorized as sedentary, light, moderate, or vigorous based on the International Physical Activity Questionnaire (IPAQ). The dietary assessment included questions about meal patterns, food preferences, and eating behaviors.

Statistical Analysis

Statistical analysis was performed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation or median with interquartile range depending on the distribution of data. Categorical variables were expressed as frequencies and percentages. Data Obtained will be tabulated in the Excel sheet and will be analyzed. Quantitative data will be expressed as mean+standard deviation and nonparametric data will be expressed as median and min-max values. Percentage will be used for qualitative data. Chi-square test for proportions in qualitative data. Student'st-test (Unpaired t-test) for Quantitative data. Pearson correlation coefficient will be calculated. Other appropriate statistical test will be applied. $P < 0.05$ was considered statistically significant.

Quality Control Measures

To ensure data quality, all measurements were performed by trained personnel using standardized protocols. Regular calibration of instruments was performed, and quality control samples were included in laboratory analyses. Double data entry was performed to minimize errors, and regular data cleaning was conducted throughout the study period.

Results

The study compared serum aminotransferase levels between 50 obese individuals and 50 normal-weight individuals, revealing significant differences in enzyme levels and prevalence of elevated enzymes.

Demographic analysis showed no statistically significant difference in age ($p=0.214$) or gender distribution ($p=0.678$) between the two groups. However, as expected, the BMI difference was highly significant ($p<0.001$), confirming the proper group classification.

Characteristic	Obese Group (n=50)	Normal Group (n=50)	p-value
Age (years)	42.5 ± 8.3	40.2 ± 7.6	0.214
Gender (M:F)	28:22	26:24	0.678
BMI	35.6 ± 4.2	22.1 ± 1.8	**<0.001**

Table 1: Demographic Characteristics of Study Participants.

Serum aminotransferase levels demonstrated marked variations between obese and normal individuals. Alanine Aminotransferase (ALT) levels were significantly higher in the obese group, with a mean of 62.4 U/L compared to 35.2 U/L in the normal group (p<0.001). Similar patterns were observed for Aspartate Aminotransferase (AST) and Alkaline Phosphatase (ALP), both showing substantially elevated levels in obese participants.z

Enzyme	Obese Group (n=50)	Normal Group (n=50)	p-value
ALT (U/L)	62.4 ± 22.7	35.2 ± 8.9	**<0.001**
AST (U/L)	54.6 ± 18.3	32.7 ± 6.5	**<0.001**
ALP (U/L)	78.3 ± 25.6	55.4 ± 12.1	**0.002**

Table 2: Serum Aminotransferase Levels.

The prevalence of elevated enzyme levels was particularly noteworthy. In the obese group, 38% of participants had ALT levels above 50 U/L, compared to only 8% in the normal group. Similarly, 32% of obese individuals had AST levels exceeding 40 U/L, versus just 6% in the normal group. The odds ratios indicate a significantly higher risk of elevated enzymes among obese individuals, with ALT showing the most pronounced difference (OR 7.42, 95% CI 2.31-23.85).

Enzyme	Obese Group	Normal Group	Odds Ratio (95% CI)
ALT >50 U/L	38% (19/50)	8% (4/50)	7.42 (2.31-23.85)
AST >40 U/L	32% (16/50)	6% (3/50)	6.95 (2.01-24.10)
ALP >75 U/L	28% (14/50)	10% (5/50)	3.56 (1.24-10.23)

Table 3: Prevalence of Elevated Aminotransferases.

Discussion

Our study provides significant insights into the relationship between obesity and serum aminotransferase levels, revealing a notable association between increased body mass and elevated liver enzyme concentrations. The findings demonstrate substantially higher levels of ALT, AST, and ALP in obese individuals compared to normal-weight controls, consistent with emerging research in hepatic metabolism and obesity-related metabolic alterations.

Comparative Analysis of Liver Enzyme Elevations

Jalli V et al.[12] in their study of 360 adult women reported similar trends, with obese individuals showing a significant association was found between BMI with ALT ($\beta = .16$, $p = .002$) and GGT ($\beta = .19$, $p = .01$) enzymes after adjustment for age. Our results align closely, demonstrating a 1.8-fold elevation in ALT (62.4 U/L vs. 35.2 U/L), substantiating the consistent pathophysiological mechanism linking obesity to hepatic stress.

A study on the risk of NAFLD development in cases of normal serum ALT levels (i.e., less than 35 U/L) found that a rise in serum ALT concentration, even within the normal range, was an independent predictor of NAFLD development.[13] In a study of diabetic patients, high-normal ALT was found to increase the incidence of non-alcoholic fatty liver by 2.7-fold.[14]

Pathophysiological Mechanisms

The elevated enzyme levels observed in our study can be attributed to several interrelated mechanisms:

1. Insulin Resistance: Obesity-induced insulin resistance leads to increased hepatic lipogenesis and inflammatory responses, directly impacting aminotransferase production.[15]
2. Visceral Adiposity: Excess adipose tissue, particularly visceral fat, releases pro-inflammatory cytokines that trigger hepatocellular damage and enzyme release.[16]
3. Metabolic Syndrome: The high prevalence of metabolic syndrome among obese individuals contributes to chronic low-grade inflammation and hepatic dysfunction.[8]

Comparative Prevalence and Risk Stratification

Our findings of significantly higher odds ratios for elevated enzymes (ALT OR 7.42, AST OR 6.95) closely mirror the results reported by Kim et al.[17], who demonstrated similar risk amplifications in their Korean population-based study. This consistency across different populations suggests a robust and generalizable relationship between obesity and liver enzyme aberrations.

Conclusion

Our study reinforces the complex relationship between obesity and hepatic metabolism, providing empirical evidence of significant aminotransferase level variations. The findings emphasize the critical need for comprehensive metabolic assessments in obese individuals.

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